Dehydration-impregnation by soaking combined with fermentation: an innovative alternative to traditional meat fermentation

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Abstract

An innovative combined method is being proposed for the fermentation of meat. The new process consists of two successive operations: a first dehydration-impregnation by soaking treatment (DIS) (also known as osmotic treatment) to partially dehydrate and to impregnate the meat fillet with salt and sugars, followed by a controlled fermentation with added starter culture. This study was undertaken to evaluate the impact of meat formulation (i.e. removal of water and addition of salt and sugars) by DIS on the kinetics of fermentation. For this, beef meat fillets were immersed in concentrated solutions of salt and glucose syrup (DE21), inoculated with *Lactobacillus sakei* and incubated under defined conditions of time, temperature and relative humidity. Results showed that the combined treatment allowed satisfactory lactic acid fermentation of the meat, with a significant 1-log increase in the number of lactic acid bacteria accompanied by a decrease of 0.4 unit in the meat pH within a fermentation period of 72h. Further work will aim at identifying the best meat formulation by DIS that allows optimal fermentation kinetics, and at better understanding the underlying biochemical mechanisms.

Keywords: meat, dehydration, salting, osmotic treatment, fermentation, starter culture

Introduction

Traditional processes of meat fermentation generally involve sequential operations of salting, fermentation and drying. They are usually lengthy processes, necessitating costly processing environments and fine technical know-how to attain precise end product quality criteria. In an attempt to shorten, simplify and to propose a technique more adapted to tropical countries than the traditional fermentation process, an innovative combined method is being proposed for the fermentation of meat. The new process consists of two successive operations: a first dehydration-impregnation by soaking treatment (DIS) followed by a controlled fermentation with added starter culture. DIS treatment in concentrated solution of salt and sugars allows simultaneous dehydration and impregnation of meat with salt and sugars (Collignan *et al.*, 2001), thus presenting a one-step alternative to sequential salting and drying as in traditional fermentation process. Among processes where heating is not used as a preservative agent, fermentation is generally regarded as a relatively efficient, low-energy preservation process which increases the shelf stability and decreases the need for refrigeration or other form of food preservation technology (Battock and Azam-Ali, 1998). In addition, depending on the starter culture used, specific organoleptic characteristics may be attained together with enhanced product safety of meat products through inhibition of spoilage and pathogenic bacteria and production of antimicrobials. Thus a combined DIS/fermentation process may provide a more appropriate alternative for meat processing in developing countries. However, to date, no study has been carried out on this combined process. Hence, the objective of this work was to evaluate the impact of meat formulation by DIS on the kinetics of fermentation.

Materials and methods

Beef meat fillets (7x5x3cm^3) were immersed in concentrated solutions of salt (50g/kg water) and glucose syrup (DE21, 950g/kg water) for 24h, inoculated with *Lactobacillus sakei* (L110 TEXEL® Danisco, 10^7 cfu/g), incubated at 25°C and 90% relative humidity for a total period of 72h. A fungicide (Delvocid®, active agent natamycin) at the level of 0.4% was added to the inoculum suspension to inhibit growth of fungi. At known incubation time intervals, meat samples were assayed for their microbiological load (lactic acid bacteria on MRS agar and yeast on Sabouraud with chloramphenicol agar), D- and L- lactic acid contents (enzymatic kits Enzytec™, SCIL Diagnostics) and pH.

Results and Discussion

After the DIS treatment, the meat fillet showed a water loss, a salt gain and sugar gain of 32, 1.7 and 6.6 g/100g initial mass respectively. Figure 1 illustrates the changes in microbial load, lactic acid contents and pH of meat during fermentation. A significant 1-log increase in the number of lactic acid bacteria within an incubation period of 72 h was observed (Figure 1a). This was accompanied by an average net decrease of 0.4 units in the meat pH which reached 4.75 (Figure 1b). Yeast growth was effectively inhibited during this period. An average of 0.35 g/100g (dry basis) of D-lactic acid was produced in the first 24 h of incubation, after which this amount decreased continuously to 0.14 g/100g (dry basis). Whereas L-lactic acid concentration, initially at 0.47 g/100g (dry basis), showed a continuous decrease throughout the incubation period to reach 0.14 g/100g (dry basis) at 72h. These observations suggest that both L and D lactic acids were utilised by microorganisms and/or other biochemical reactions during the incubation period.

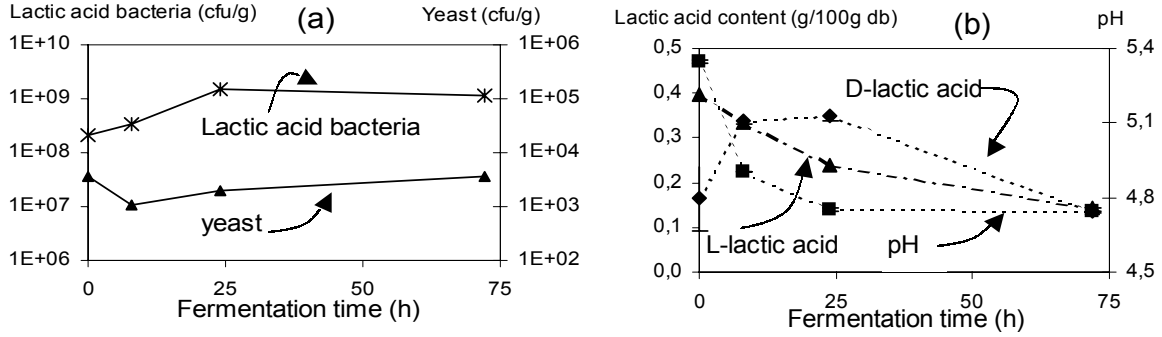

Figure 1: Change in (a) microbial load, (b) meat pH, D- and L-lactic acid contents during fermentation of DIS-treated meat fillet

Conclusion

This study clearly indicated that lactic acid fermentation occurred in a meat fillet that had been previously dehydrated and impregnated with salt and sugars by DIS treatment. Further work will aim at identifying the best meat formulation by DIS that allows optimal fermentation kinetics, and at better understanding the underlying biochemical mechanisms.

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